Context, control & bilingual cognitive flexibility

COM 2018

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Center for Neural and Cognitive Sciences
University of Hyderabad

Dedicated to Albert Costa….

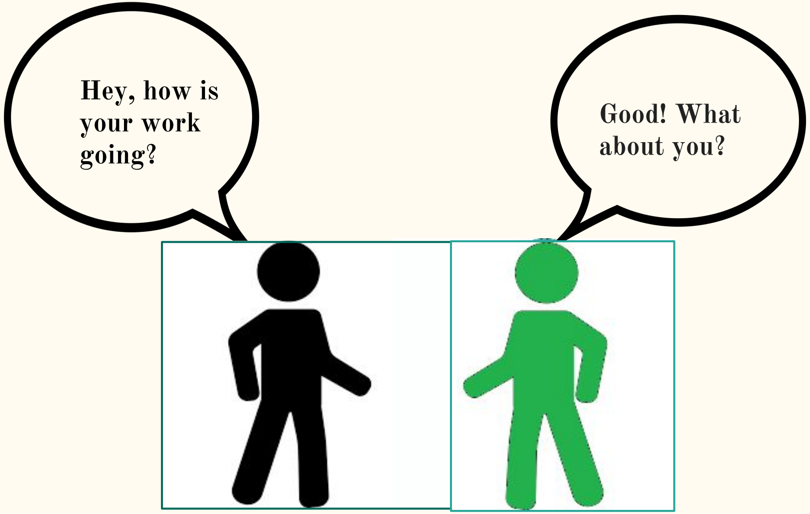
Find the podcast at: https://actioncontrolcognitionlaboratory.wordpress.com/Podcasts

Roadmap

- Language context and control
- Nature of bi- and multilingualism in India
- Interactional context and lexical selection
- Interactional context and executive control
- Theoretical synthesis
- Future research

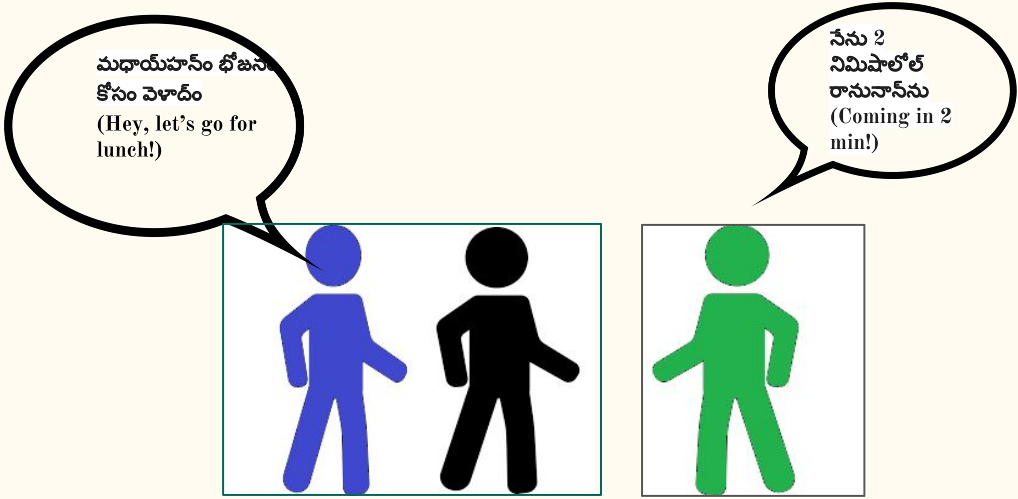
Language context and control

Bilingualism is context-bound

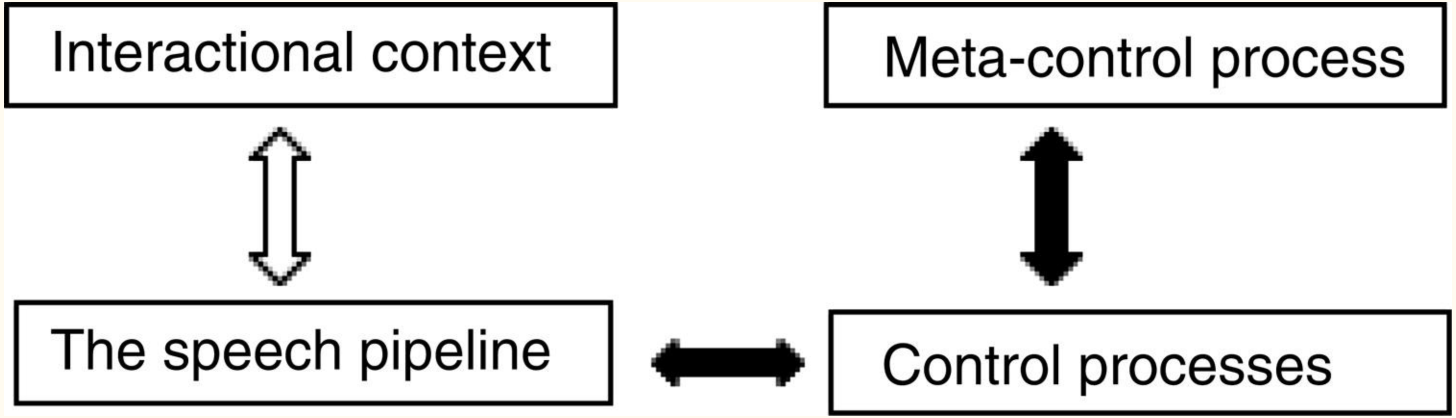

Hey, how is your work going?
Good! What about you?

Lexical selection and control is dynamically influenced by context

Bilinguals dynamically switch between their languages depending on - where they are and who they are talking to



Adaptive control hypothesis (Green & Abutalebi, 2013)



Interactional context

Meta-control process

The speech pipeline

Control processes

Key questions

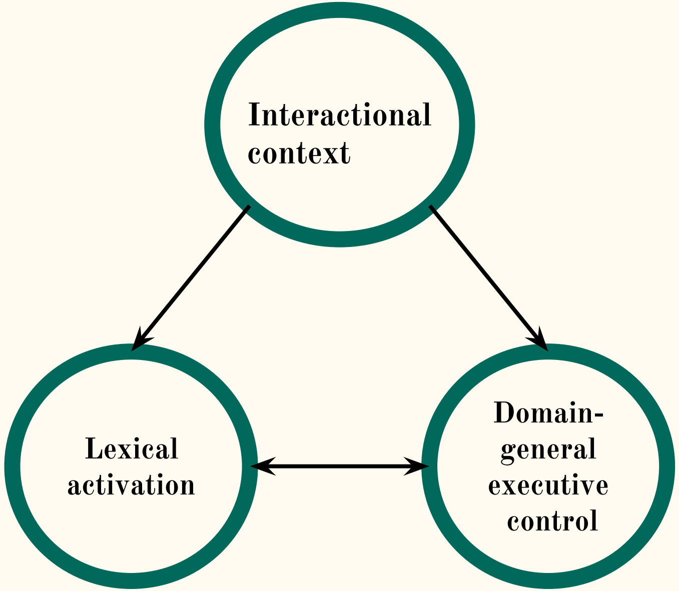
- Do people adjust to the interlocutor’s langage? (Molnar et al., 2015)
- Is the interlocutor’s linguistic knowledge/competence analysed dynamically? (Woumans et al., 2015)
- Is such an influence possible when speech is voluntarily generated?(Kapiley & Mishra, 2018)
- Do speakers suppress their preferred language (dominance) to accommodate interlocutor's preference?

More questions...

1. What are the control mechanisms involved in dynamic adjustments to interlocutors?

2. Which components of executive control (inhibition, monitoring, selective attention etc) are involved?

3. Does the interactional context directly modulate general executive functions?

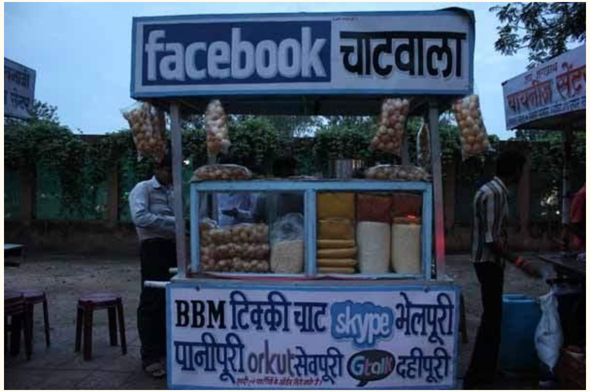


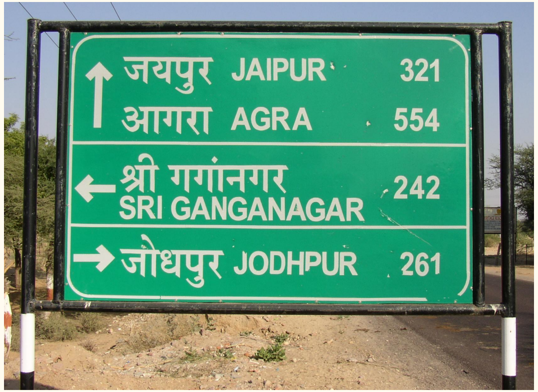
Interactional context

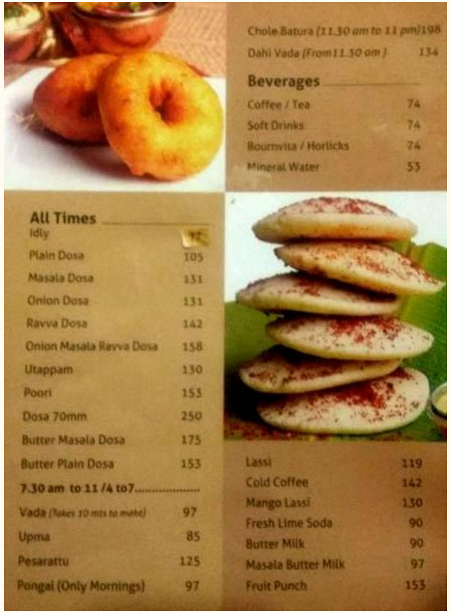
Lexical activation

Domain-general executive control

Nature of bi- and multi-lingualism in India


facebook चाटवाला
BBM टिक्की चाट skype भेलपूरी
पानीपूरी orkut सेवपूरी Gtalk दहीपूरी





Chole Batura *(11.30 am to 11 pm)*	198
Dahi Vada *(From11.30 am)*	134

Beverages

Coffee / Tea	74
Soft Drinks	74
Bournvita / Horlicks	74
Mineral Water	53

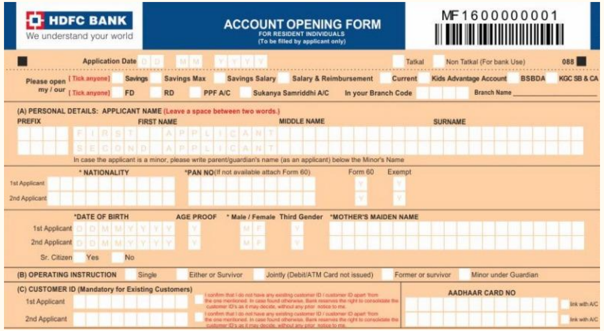
All Times

Idly	[illegible]
Plain Dosa	105
Masala Dosa	131
Onion Dosa	131
Ravva Dosa	142
Onion Masala Ravva Dosa	158
Utappam	130
Poori	153
Dosa 70mm	250
Butter Masala Dosa	175
Butter Plain Dosa	153

7.30 am to 11 /4 to7..................

Vada *(Takes 10 mts to make)*	97
Upma	85
Pesarattu	125
Pongal (Only Mornings)	97

Lassi	119
Cold Coffee	142
Mango Lassi	130
Fresh Lime Soda	90
Butter Milk	90
Masala Butter Milk	97
Fruit Punch	153



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[Tick anyone] ☐ FD ☐ RD ☐ PPF A/C ☐ Sukanya Samriddhi A/C In your Branch Code ☐☐☐☐ Branch Name ____________

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SECOND APPLICANT

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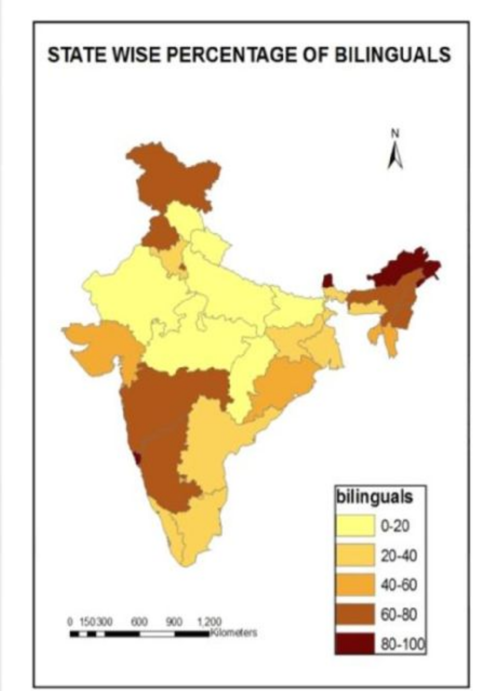
Bilingualism in India

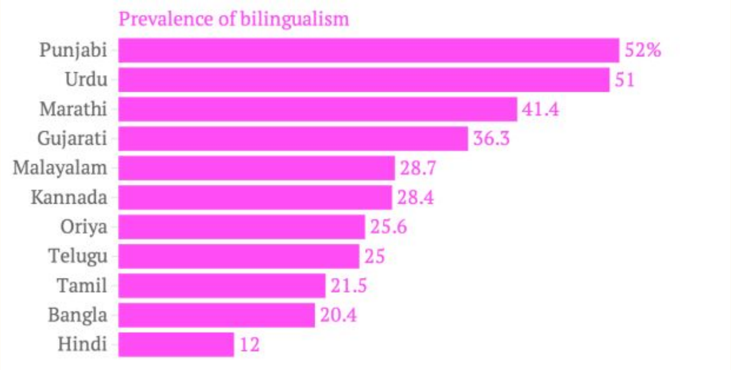
- Most University students in India are bilinguals
- Monolingualism in India is confounded with illiteracy
- Contrasting high and low L2 University students is ecologically valid in the Indian context
- In Indian universities, both groups of students exist in the same classroom, receive the same instruction and live in the same bilingual context.



Source: Census, 2011

Issues while studying bilingual language control in the Indian context

- Nature of bilingualism is province specific
- Quantum of shifting and switching differs from state to state even when L2 as second language is kept constant
- Quantum of bilingualism in younger adults and older adults maybe different(Mishra et al., under review)
- Very few empirical studies (Alladi et al., 2013, 2016; Khare et al., 2013) - maybe because theoretical issues related to bilingualism do not affect everyday life much.

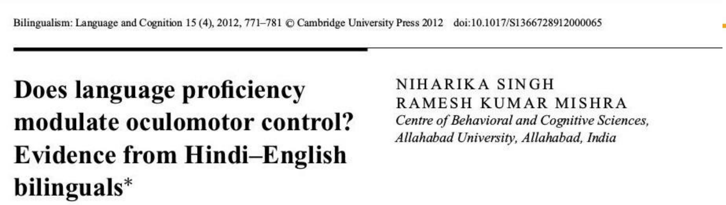


Source: Census, 2011

Second language proficiency as a grouping variable

- Fluency
- Comprehension skills
- Writing ability
- Meta-linguistic abilities
- Naming speed
- Age of acquisition
- Level of education
- Socio economic factors

My studies with Indian bilinguals (parallel activation ⟷ control)



Bilingualism: Language and Cognition 15 (4), 2012, 771–781 © Cambridge University Press 2012 doi:10.1017/S1366728912000065

Does language proficiency modulate oculomotor control? Evidence from Hindi–English bilinguals*

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RAMESH KUMAR MISHRA
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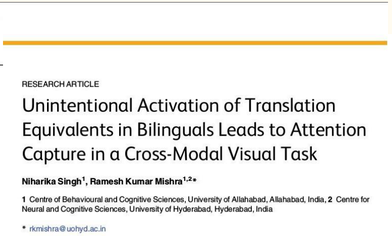

RESEARCH ARTICLE

Unintentional Activation of Translation Equivalents in Bilinguals Leads to Attention Capture in a Cross-Modal Visual Task

Niharika Singh[1], Ramesh Kumar Mishra[1,2]*

1 Centre of Behavioural and Cognitive Sciences, University of Allahabad, Allahabad, India, 2 Centre for Neural and Cognitive Sciences, University of Hyderabad, Hyderabad, India

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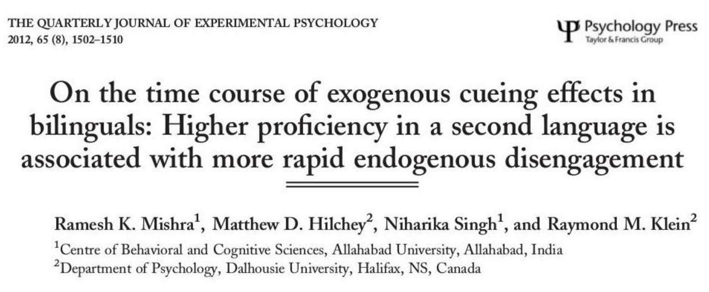

THE QUARTERLY JOURNAL OF EXPERIMENTAL PSYCHOLOGY
2012, 65 (8), 1502–1510

Psychology Press
Taylor & Francis Group

On the time course of exogenous cueing effects in bilinguals: Higher proficiency in a second language is associated with more rapid endogenous disengagement

Ramesh K. Mishra[1], Matthew D. Hilchey[2], Niharika Singh[1], and Raymond M. Klein[2]

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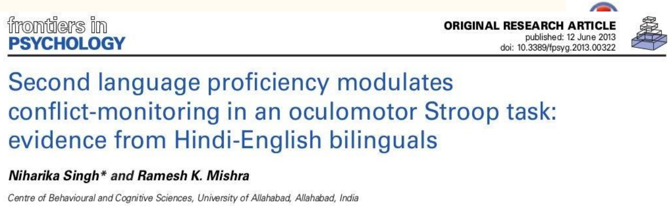

frontiers in PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 12 June 2013
doi: 10.3389/fpsyg.2013.00322

Second language proficiency modulates conflict-monitoring in an oculomotor Stroop task: evidence from Hindi-English bilinguals

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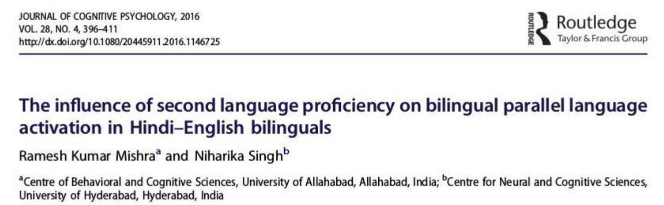

JOURNAL OF COGNITIVE PSYCHOLOGY, 2016
VOL. 28, NO. 4, 396–411
http://dx.doi.org/10.1080/20445911.2016.1146725

Routledge
Taylor & Francis Group

The influence of second language proficiency on bilingual parallel language activation in Hindi–English bilinguals

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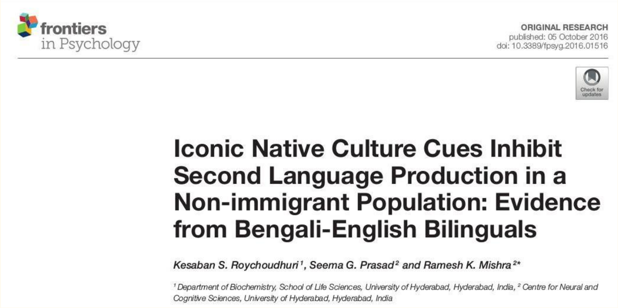


frontiers in Psychology

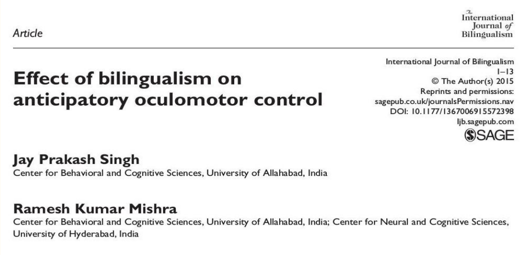
ORIGINAL RESEARCH
published: 05 October 2016
doi: 10.3389/fpsyg.2016.01516

Check for updates

Iconic Native Culture Cues Inhibit Second Language Production in a Non-immigrant Population: Evidence from Bengali-English Bilinguals

*Kesaban S. Roychoudhuri[1], Seema G. Prasad[2] and Ramesh K. Mishra[2]**

[1] Department of Biochemistry, School of Life Sciences, University of Hyderabad, Hyderabad, India, [2] Centre for Neural and Cognitive Sciences, University of Hyderabad, Hyderabad, India



Article

The International Journal of Bilingualism

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1–13
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Effect of bilingualism on anticipatory oculomotor control

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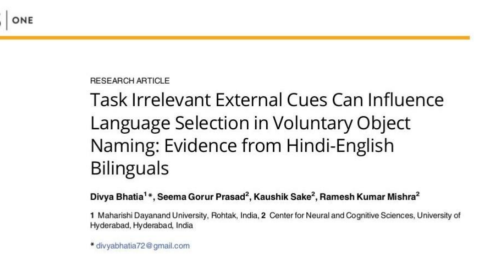
PLOS | ONE



RESEARCH ARTICLE

Task Irrelevant External Cues Can Influence Language Selection in Voluntary Object Naming: Evidence from Hindi-English Bilinguals

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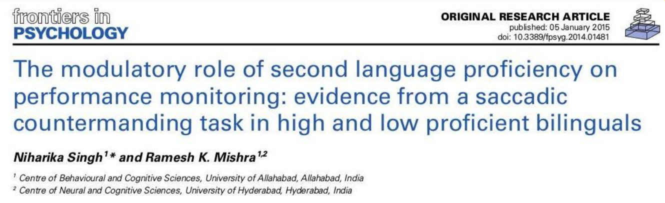

frontiers in PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 05 January 2015
doi: 10.3389/fpsyg.2014.01481

The modulatory role of second language proficiency on performance monitoring: evidence from a saccadic countermanding task in high and low proficient bilinguals

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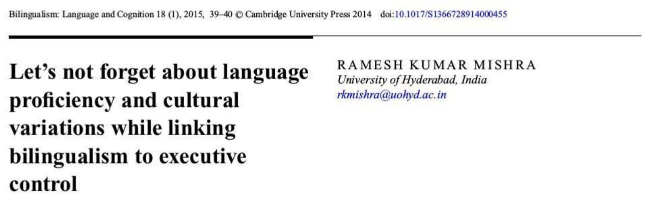
[2] Centre of Neural and Cognitive Sciences, University of Hyderabad, Hyderabad, India



Bilingualism: Language and Cognition 18 (1), 2015, 39–40 © Cambridge University Press 2014 doi:10.1017/S1366728914000455

Let's not forget about language proficiency and cultural variations while linking bilingualism to executive control

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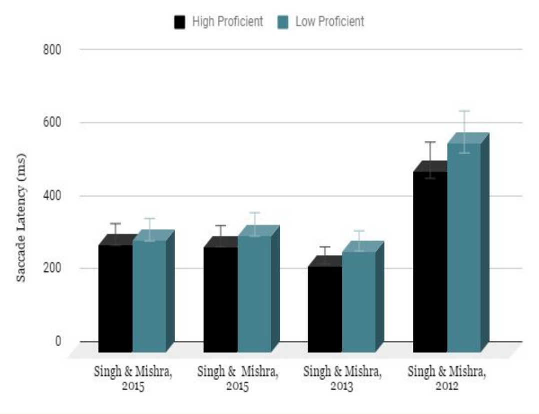
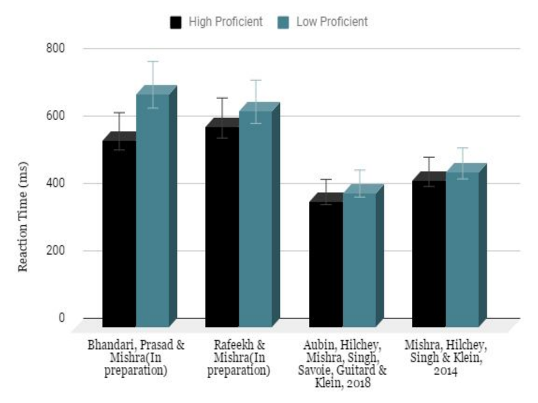
Most consistent finding in Indian bilinguals

Global RT/saccade latency advantage has been consistently found in all our previous studies with executive control tasks



Studies measuring eye-movements

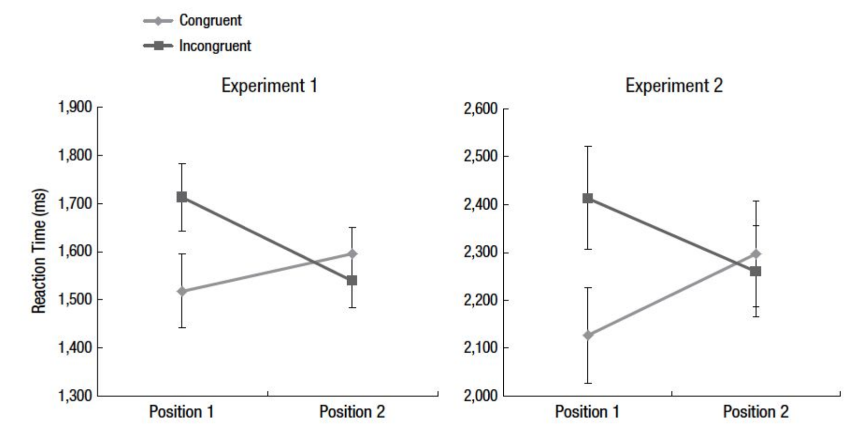


Studies measuring manual RT

Interactional context and lexical selection

Faces can prime a language

- Does a familiar face serve as a language cue that affects language activation?
- Familiarised faces through skype interactions - Catalan and Spanish
- Language production task - interlocutor uttered words in the same language they had spoken during the Skype interactions (congruent trials) or in a different language (incongruent trials).
- Participants produced words faster on congruent trials compared to incongruent trials
- This effect disappeared as the experiment progressed since the participants realised the faces can speak both languages - predictive value of the faces diminished

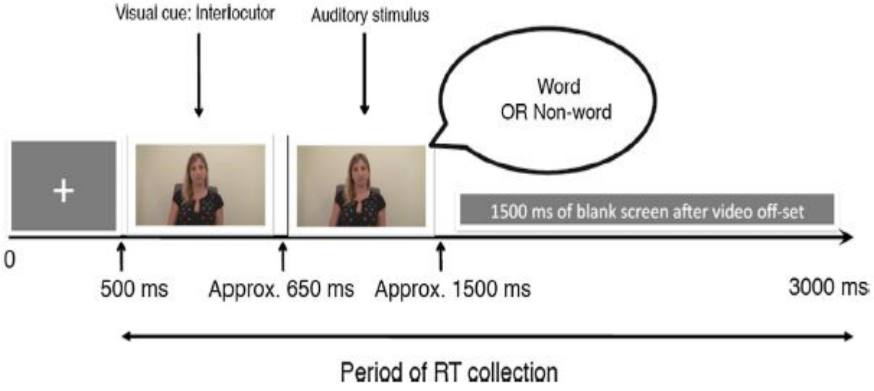


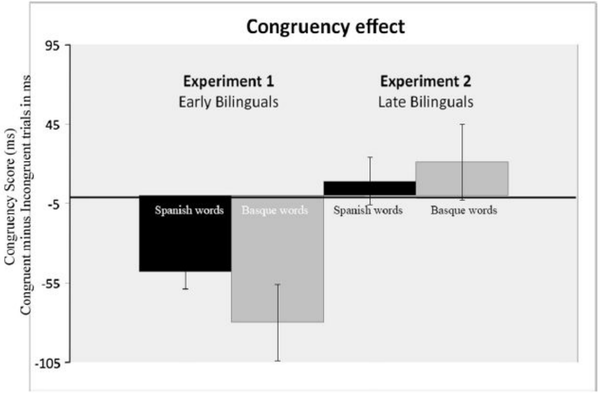
Position 1: First 6 trials
Position 2: Rest of the trials

Woumans et al.(2015)
Psychological Science

Interlocutor identity modulates lexical activation

- Is bilinguals' language activation affected by non-linguistic cues (e.g., interlocutor identity)?
- Early and late Basque–Spanish bilinguals - familiarized with interlocutors - Spanish, Basque, or both languages
- Audio–visual lexical decision task- interlocutors produced words in Spanish or Basque
- Faster responses when language of the interlocutors matched the language associated with them
- This effect observed only in early bilinguals (Experiment 1). Late bilinguals not affected by interlocutors (Experiment 2).

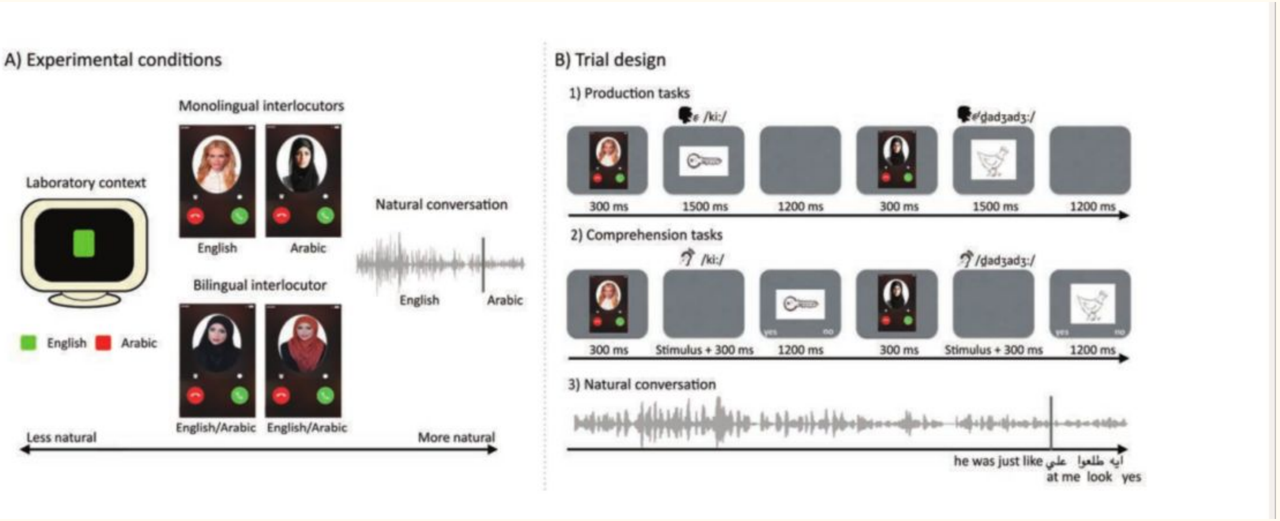




Molnar et al.(2015)
Journal of Memory and Language

Bilingualism in the wild - neural basis

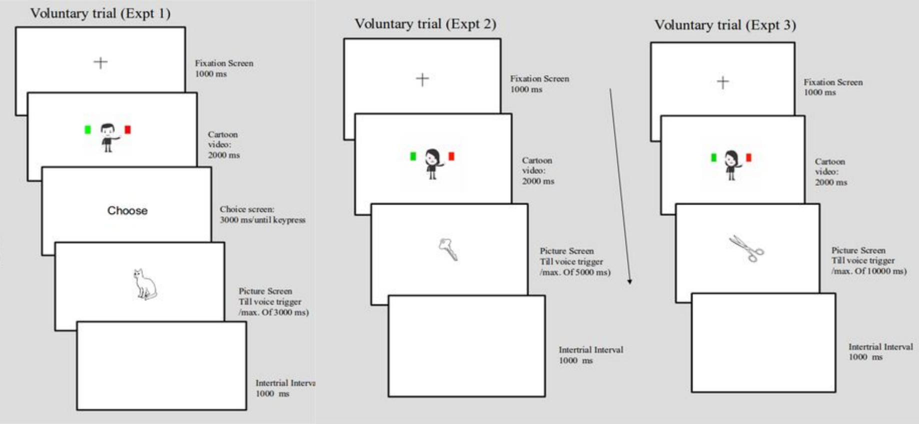
- Investigated language switching behaviour in1) an artificial switching paradigm (cued) 2) the presence of interlocutors (bilingual and monolingual) 3)natural conversation
- Production and comprehension task post familiarisation with Arabic-English interlocutors.
- Production: switching voluntarily in a natural context is effortless - no switch costs and decreased engagement of executive control areas
- Comprehension: artificially cued switches engaged executive control areas more, natural switching involved only auditory cortices.



Blanco-Elorrieta & Pylkkänen., 2017
J. Neuroscience

Passive agents can influence language choice

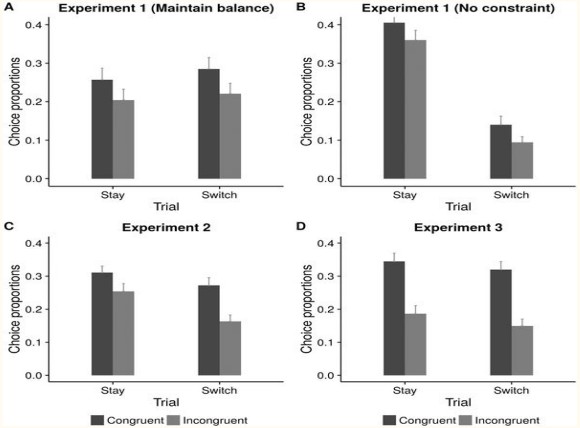
- Cartoons waved at a colour patch (linked to L1 and L2) before participants named an object (on both cued and voluntary trials)
- Participants chose and switched more often to the language indicated by the cartoon.
- This influence was seen even though the cartoons were irrelevant to the main task.
- No effect of the cartoons on naming latency


Voluntary trial (Expt 1)
Fixation Screen 1000 ms
Cartoon video: 2000 ms
Choose
Choice screen: 3000 ms/until keypress
Picture Screen Till voice trigger /max. Of 3000 ms)
Intertrial Interva 1000 ms
Voluntary trial (Expt 2)
Fixation Screen 1000 ms
Cartoon video: 2000 ms
Picture Screen Till voice trigger /max. Of 5000 ms)
Intertrial Interval 1000 ms
Voluntary trial (Expt 3)
Fixation Screen 1000 ms
Cartoon video: 2000 ms
Picture Screen Till voice trigger /max. Of 10000 ms)
Intertrial Interval 1000 ms

Explicit choice

Direct naming

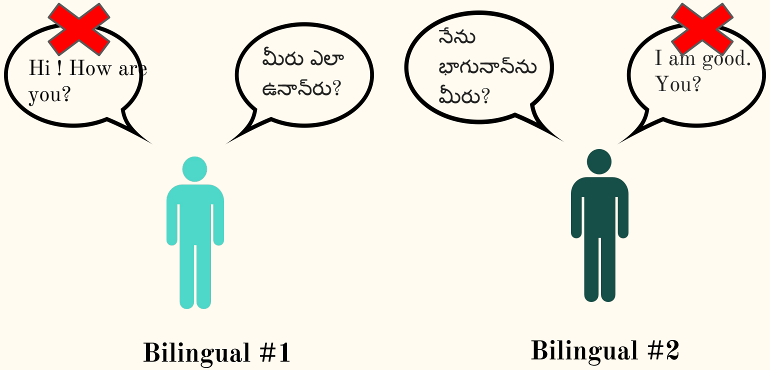
Direct naming with long preparation time



Bhatia et al., 2017
PLOS One

Interlocutors' language proficiency can bias voluntary language selection

- Are bilinguals sensitive to the **language proficiency** of their interlocutors?
- Is this sensitivity seen when bilinguals are generating speech voluntarily
- How does a bilingual's own dominance interact with the interlocutor's influence?



Kapiley & Mishra (2018)
Bilingualism, Language & Cognition

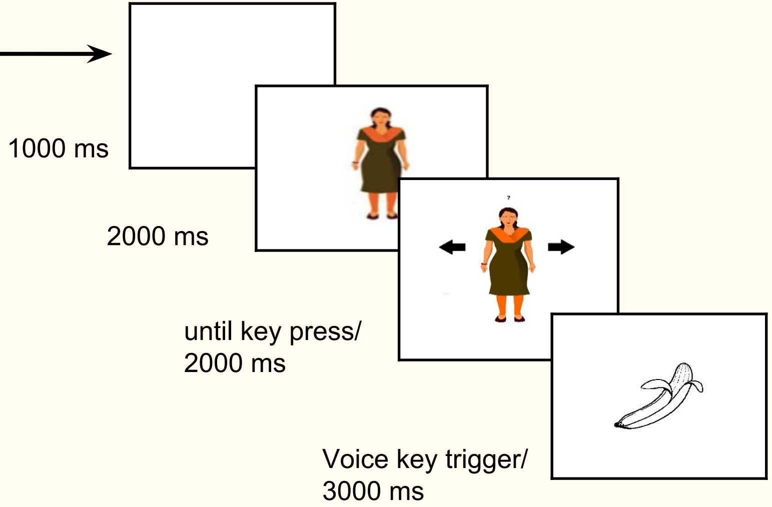
Exposure → **Experiment**

1 min video of a monologue by the interlocutor (on pollution, for eg.)

High L2 proficient (HP) interlocutor

Low L2 proficient (LP) interlocutor

Neutral interlocutor: No video/unfamiliar



Participants: Telugu - English bilinguals dominant in English

Experiment 1 n = 44

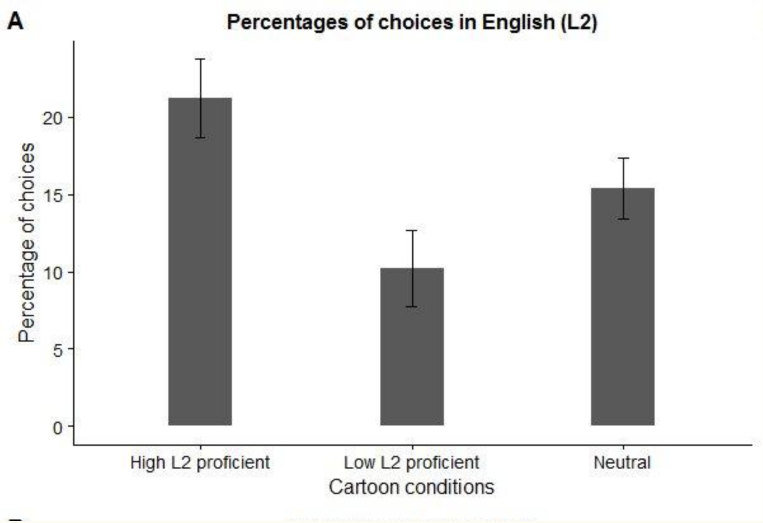
Experiment 2 n = 40

Experiment 1 (explicit choice):
Press LEFT to choose English and RIGHT to choose Telugu
Name the object in the language chosen

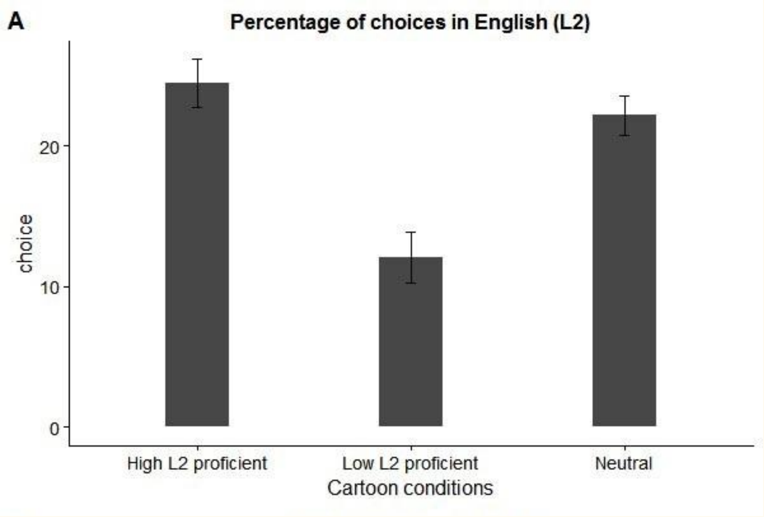
Experiment 2 (direct naming):
Name the object in the language of your choice

Kapiley & Mishra (2018)
Bilingualism, Language & Cognition

Experiment 1



Experiment 2

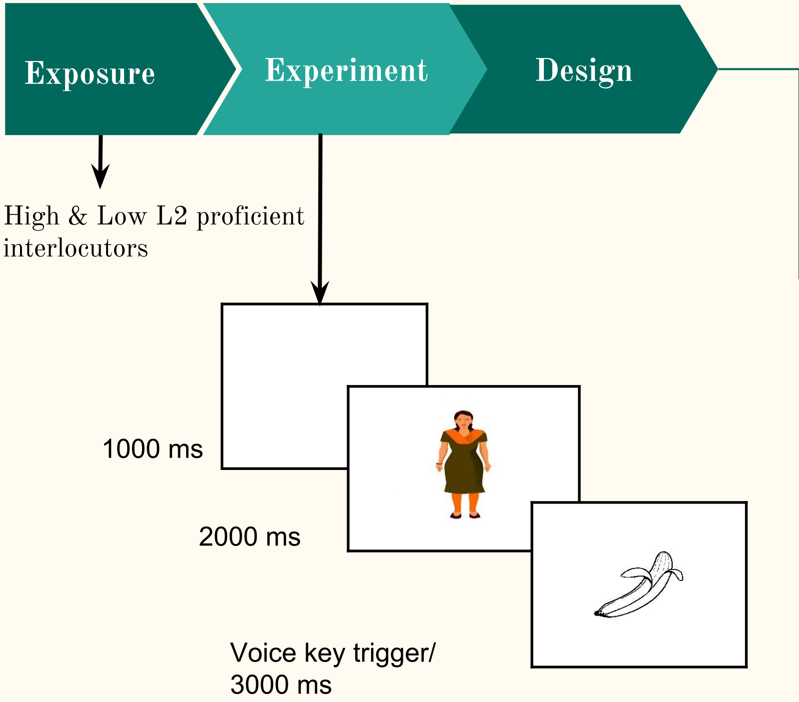


- Participants chose the language appropriate for the interlocutor
- Interestingly, English-dominant bilinguals adapted to a low L2 interlocutor
- No interlocutor specific effects on naming latency

Kapiley & Mishra (2018)
Bilingualism, Language & Cognition

Bilinguals adapt to the dominant language-context

How do bilinguals adapt to different language contexts induced by HP and LP interlocutors presented at different proportions in a block?

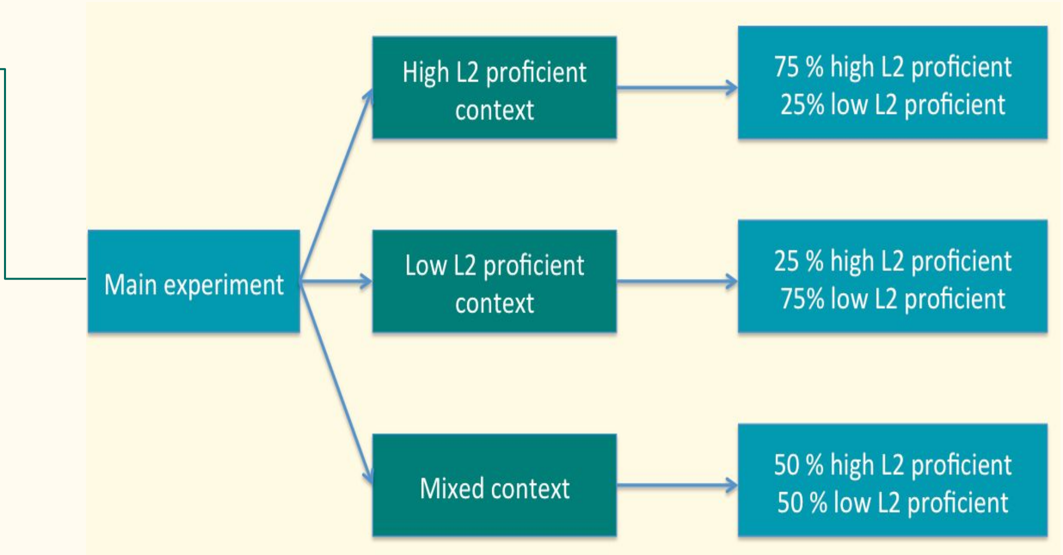


Exposure

High & Low L2 proficient interlocutors

Experiment

Design



Main experiment

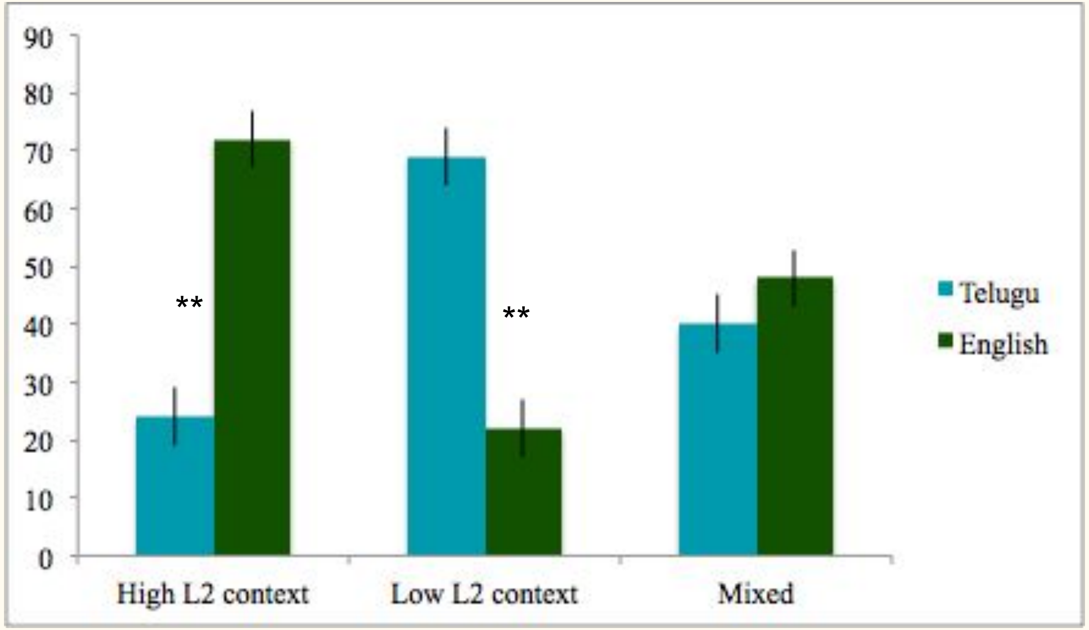
High L2 proficient context → 75 % high L2 proficient
25% low L2 proficient

High L2 proficient context	75 % high L2 proficient 25% low L2 proficient
Low L2 proficient context	25 % high L2 proficient 75% low L2 proficient
Mixed context	50 % high L2 proficient 50 % low L2 proficient

Participants: 30 Telugu-English bilinguals dominant in English

Task: Name the object in the language of your choice

Percentage of choices – Telugu and English



- Participants chose the language (eg., English) appropriate for the dominant context (eg., in a high L2 proficient context)

- Bilinguals adapted to a Low L2-proficient context in spite of being L2-dominant.

Tracking the interlocutor influence on language selection through eye movements*

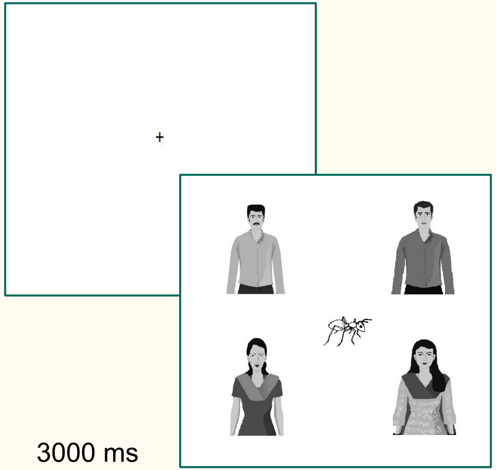
Exposure

Experiment

High proficient interlocutor

Low proficient interlocutor

Neutral interlocutor: No video/unfamiliar



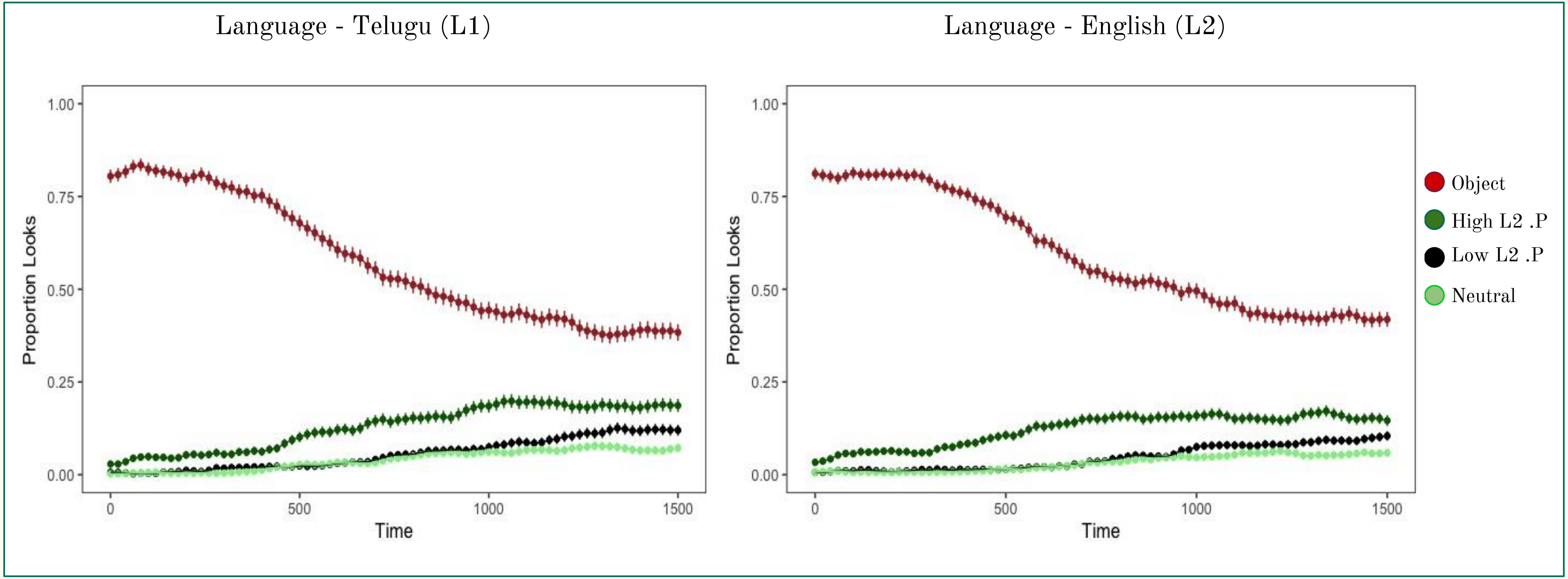
Experiment

- **Participants:** 20 Telugu-English bilinguals dominant in English
- HP, LP and neural interlocutors on display
- **Task:** Name the object in the language of your choice

---

*in progress

Eye movements 1500 ms **before** voice-onset



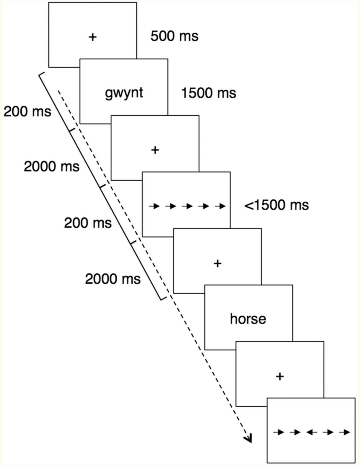
- Participants looked at high L2 proficient interlocutor when they named in English as well as in Telugu - no influence of the interlocutors
- Participants' dominance decided where they looked before they named the object

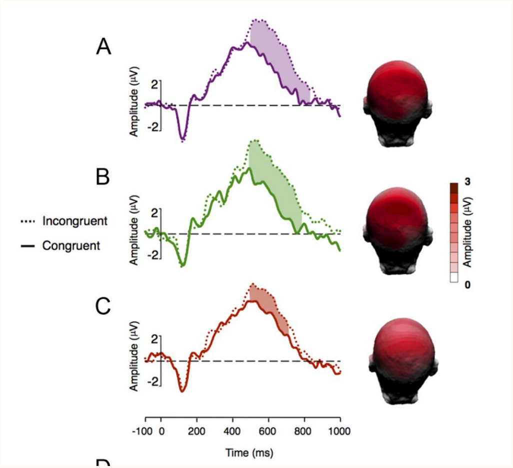
Summary

- Bilinguals choose a language appropriate for their interlocutor
- This adaptation often overrides participants' dominance (maybe not always)
- Language switching in the real world probably arises out of such adaptation - switching may not necessarily be costly!
- Adaptation is not categorical (bilingual vs. monolingual) - language proficiency plays a role

Interactional context and executive control

Language context modulates non-linguistic conflict resolution





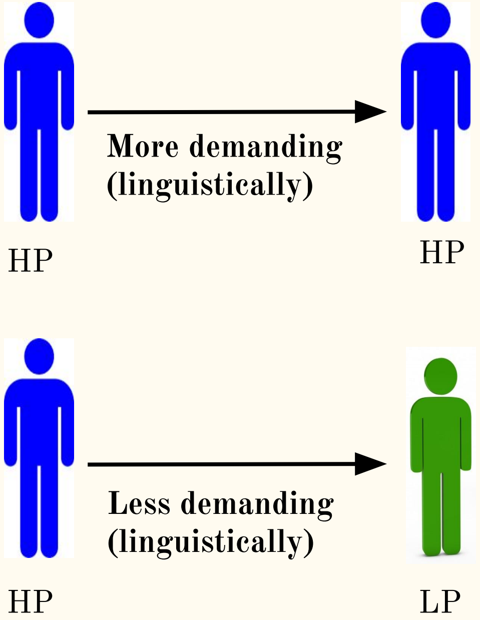
- Mixed context: Words presented in English & Welsh
- English context: Words presented only in English
- English context: Words presented only in Welsh

- Better conflict resolution (reduced errors and reduced P300 on incongruent trials) in mixed context

Wu & Thierry, 2013
J. Neuroscience

Interlocutors can influence conflict resolution in bilinguals

- Do the linguistic demands of an interlocutor reactively modulate cognitive control abilities in a bilingual?
- A HP-HP interaction is more demanding because both the languages need to be active - more switching
- Such a conflicting situation can shift the executive system to an enhanced level - the consequences of which can be seen in an executive control task



More demanding (linguistically)

Less demanding (linguistically)

Exposure → **Interaction** → **Experiment**

Simulated questions by the interlocutor

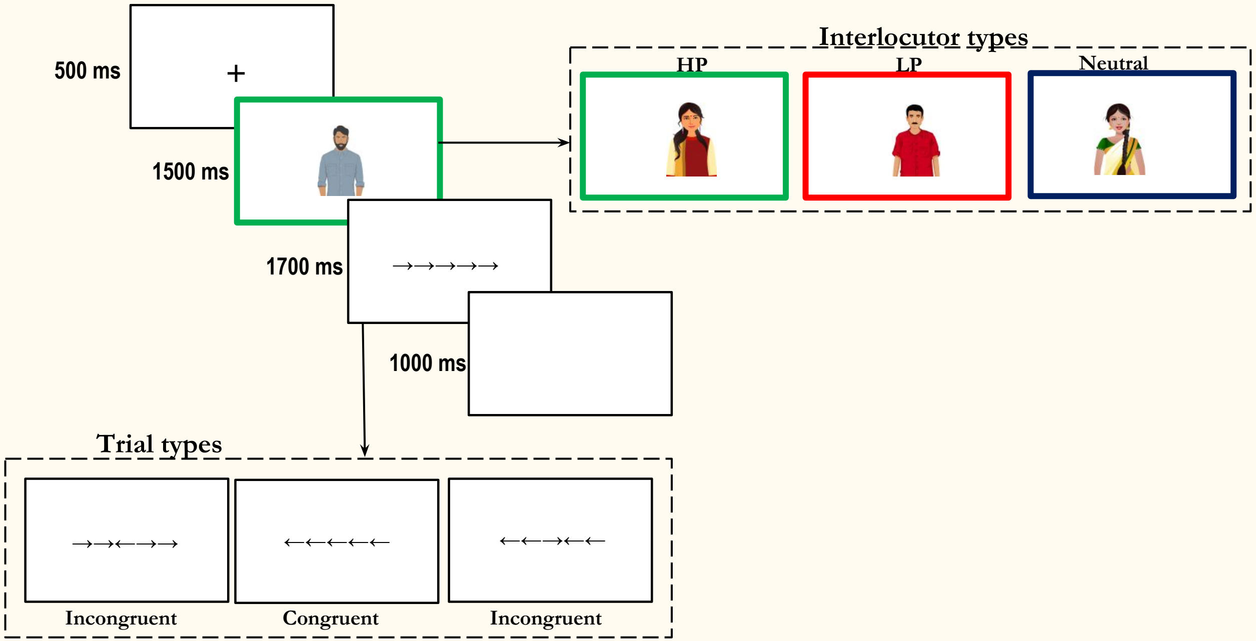
Interlocutor: My name is Swathi. What is yours?

Participant: Aniruddha

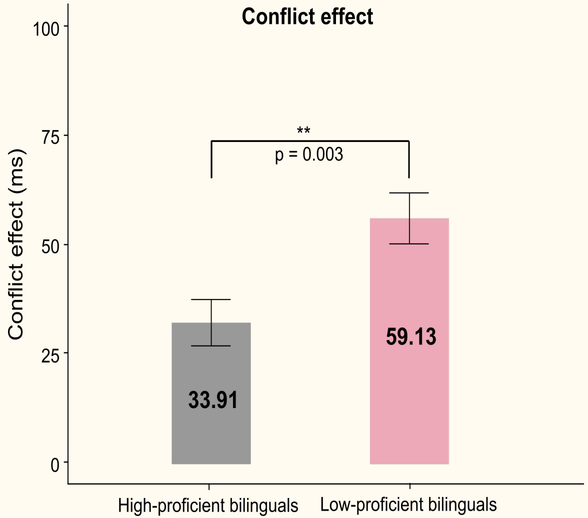
Interlocutor: Which course are you in?

Participant:.....

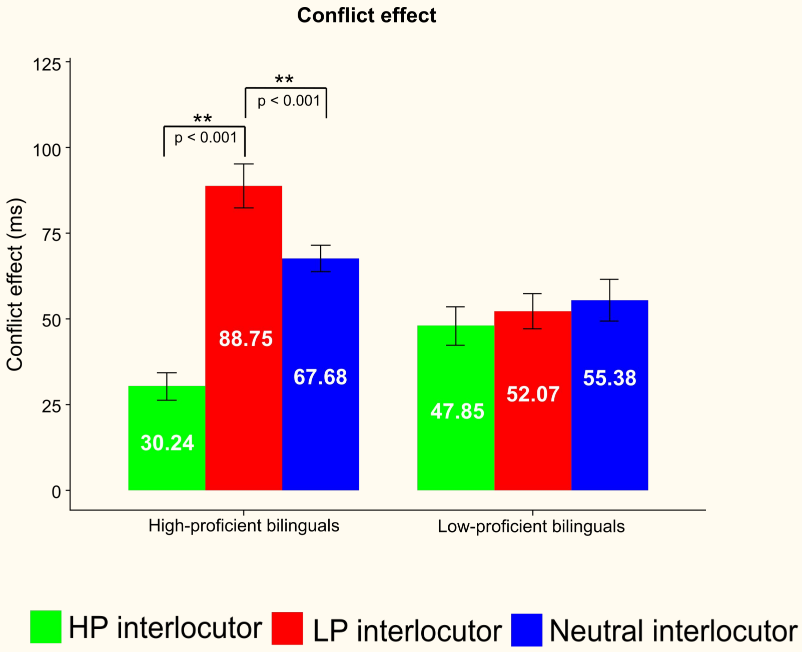
Participants: 80 Malayalam - English bilinguals



A. Baseline - no interlocutor



B. HP, LP and neutral interlocutor



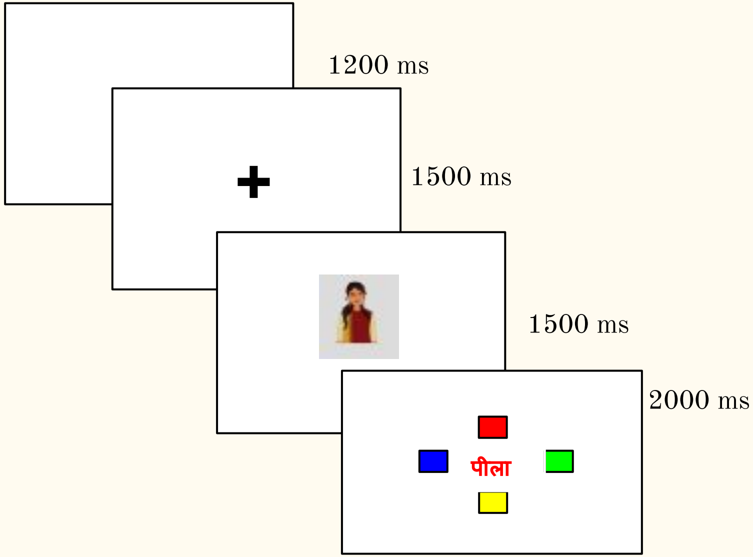
← Participants

← Interlocutors

- HP participants - better conflict resolution (lesser conflict effect) in the presence of high-proficient interlocutors
- Demands of interacting with a HP interlocutor - enhances executive functioning - reflects in a conflict resolution task
- LP participants responded similarly for all types of interlocutors

Does interactional context modulate oculomotor control?*

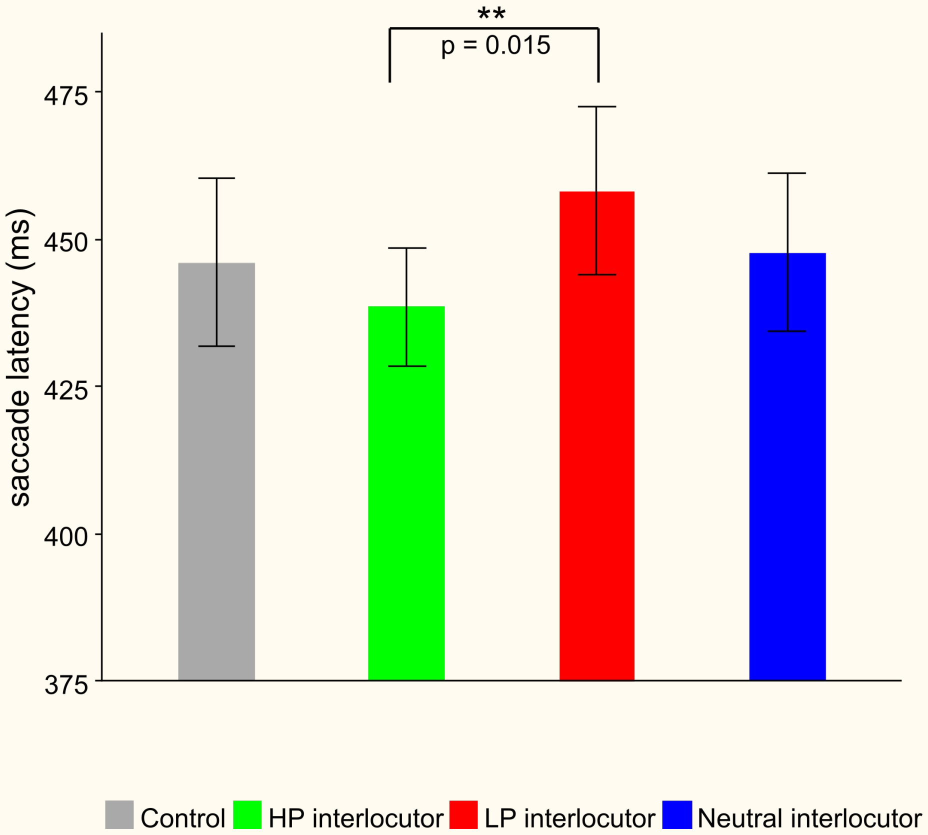
- Oculomotor control: executing goal-directed saccades while inhibiting irrelevant saccades.
- Singh and Mishra (2012, BLC) found HP bilinguals show better oculomotor control compared to LP
- Replication of Singh and Mishra (2012) with the addition of HP, LP and neutral interlocutors on each trial



Participants told to look at the colour patch matching the font colour of the written word

Congruent trial: ***laal/red***
Incongruent trial: ***peela/yellow***

*in progress



- N = 15 Malayalam - English bilinguals
- Faster saccades in the presence of HP interlocutors
- No effect of the interlocutors on conflict effect

*in progress

Summary

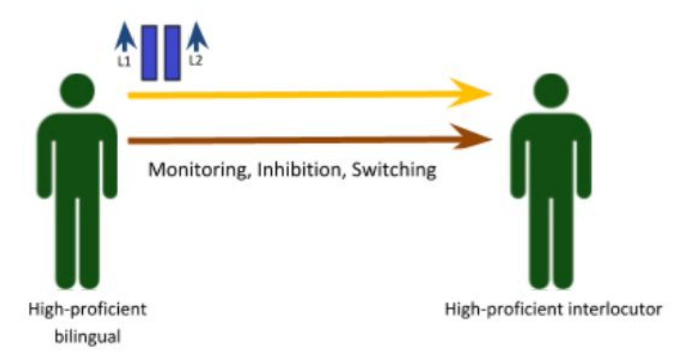
- Bilingual executive control is modulated by dynamic changes in the interactional context

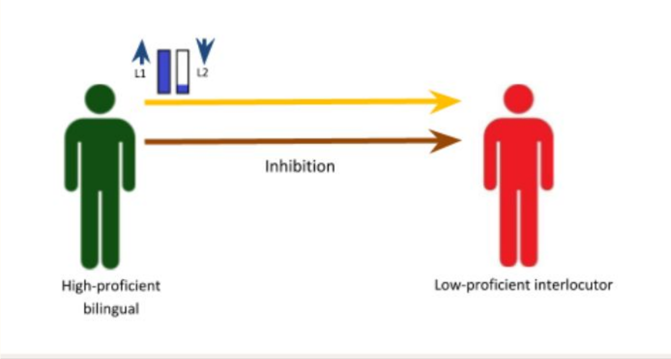
- High proficient bilinguals bring in better control in demanding situations (Costa et al., 2009) - even when these demands are induced by interlocutors

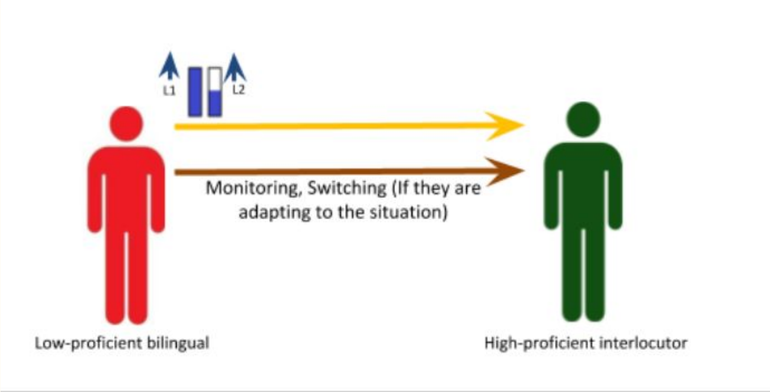
- These effects extend to the ocular domain

Theoretical synthesis

How does context interact with L2 proficiency?


L1
L2
Monitoring, Inhibition, Switching
High-proficient bilingual
High-proficient interlocutor




L1
L2
Monitoring, Switching (If they are adapting to the situation)
Low-proficient bilingual
High-proficient interlocutor

Future research

- Examining the psycholinguistic, cognitive, social-psychological and neural aspects of the interlocutor's influence in-depth

- Interlocutor effects on cross-linguistic activation and links with L2 proficiency

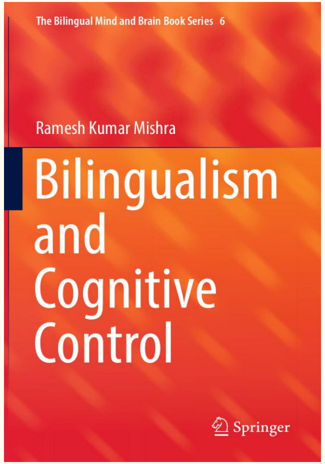
- Why are bilinguals sensitive to their interlocutors? Connections with the evolution of bilingualism (Mishra, 2018; Chapter 2)

- Involvement of domain-general control systems

- Cognitive control theories have to interact with psycholinguistic and social neuroscience theories

- Study of bilinguals on the move - immigrants, bilinguals in a foreign-language context

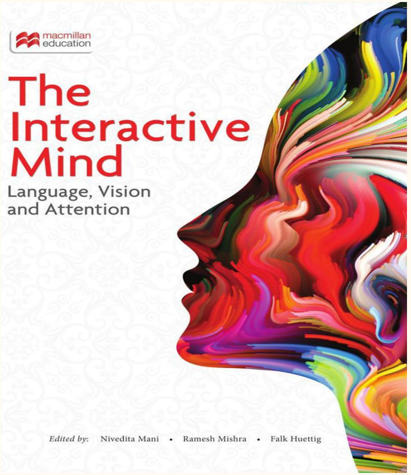
My ideas on bilingualism captured in a few recent books


The Bilingual Mind and Brain Book Series 6

Ramesh Kumar Mishra

Bilingualism and Cognitive Control

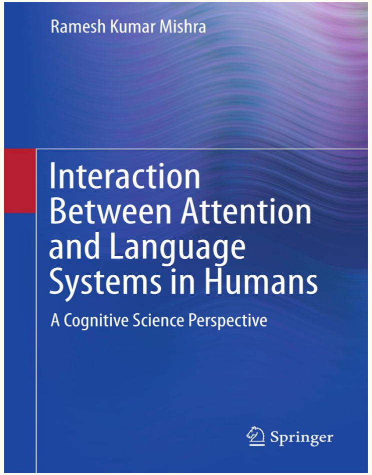
Springer


macmillan education

The Interactive Mind

Language, Vision and Attention

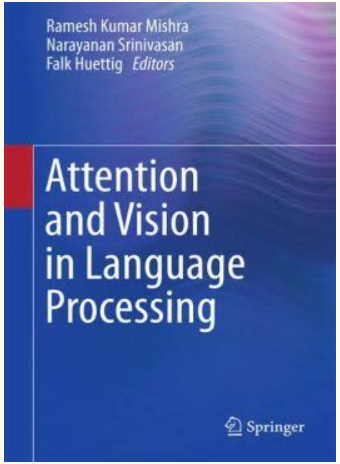
Edited by: Nivedita Mani • Ramesh Mishra • Falk Huettig


Ramesh Kumar Mishra

Interaction Between Attention and Language Systems in Humans

A Cognitive Science Perspective

Springer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Falk Huettig *Editors*

Attention and Vision in Language Processing

Springer

Action Control and Cognition Lab

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- Seema Prasad
- Riya Rafeekh

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Thank You